

Esercizi - 2023-03-14

Business Intelligence per i Servizi Finanziari 2023-2024

Antonio Candelieri

Exercise #1

- ▶ Assume you have invested 100 € on Italy Government bonds. The security has a 4% annual interest rate, a semiannual frequency of payment of interests and a maturity at 5 years.
- ▶ What is the payoff of the investement at the maturity date?
- ▶ And what is the profit?
- ▶ 10 Minutes to solve...



Excercise #1 - Solution

- ▶ Remind the formula for the payoff: $P_n = P_0 (1+r/m)^{nm}$
- ▶ Data: $P_0 = 100 \text{ €}$; $r = 0.04$; $m = 2$; $n = 5$

- ▶ Then, the payoff is:

$$P_{5\text{-years}} = P_0 (1 + 0.04 / 2)^{5 \times 2} = 100 \text{ €} (1 + 0.02)^{10} = 100 \text{ €} (1.02)^{10} = \underline{121.90 \text{ €}}$$

- ▶ Then, profit is simply the payoff discounted of the principal P_0 :

$$P_{5\text{-years}} - P_0 = 121.90 \text{ €} - 100 \text{ €} = \underline{21.90 \text{ €}}$$

Excercise #2

- ▶ Now, compare the previous investment with the following one:
 - ▶ 200 € on France Government bonds,
 - ▶ 3.6% annual interest rate (instead of 4%),
 - ▶ a quarterly (instead of semiannual) frequency of payment of interests
 - ▶ and a maturity at 5 years (as in the previous case).
- ▶ Which is the investment with the highest profit?
- ▶ 10 Minutes to solve...



Excercise #2 - Solution

► Data: $P_0 = 200 \text{ €}$; $r = 0.036$; $m = 4$; $n = 5$

► Then, the payoff of the investment on French bonds is:

$$P_{5\text{-years}} = P_0 (1 + 0.036 / 4)^{5 \times 4} = 200 \text{ €} (1 + 0.009)^{20} = 200 \text{ €} (1.1962)^{20} = \underline{\underline{239.25 \text{ €}}}$$

► While the profit is

$$P_{5\text{-years}} - P_0 = 239.25 \text{ €} - 200 \text{ €} = \underline{\underline{39.25 \text{ €}}}$$

The profit is higher in this case (39.25 € vs 21.90 €), but be carefull! you need 200 € to invest as principal!

If you have 200 € you could invest twice in italian bonds and obtain $2 \times 21.90 \text{ €} = 43.80 \text{ €!!!}$

Excercise #3

- ▶ Now, assume you have invested in stocks and obtained a profit of 10 € after 1 year
- ▶ Has this investment a profit higher than 100 € invested on the italian bonds?
- ▶ And than 200 € invested on the french bonds?
- ▶ What if the profit from stocks is 3.50 € in 6 months?
- ▶ 10 Minutes to solve...



Excercise #3 - Solution

- ▶ Remind the formula for continuous compounding, that is $P_{\tau} = P_0 e^{r\tau}$

- ▶ Data:

$$P_0^{IT} = 100 \text{ €}; r^{IT} = 0.04; \tau = 1$$

$$P_0^{FR} = 200 \text{ €}; r^{FR} = 0.036; \tau = 1$$

stocks profit after 1 year 10 €

- ▶ Then, the continuously compounded profits for bonds are:

$$P_{1y}^{IT} - P_0^{IT} = 100 \text{ €} e^{0.04 \times 1} - 100 \text{ €} = 4.08 \text{ €}$$

$$P_{1y}^{FR} - P_0^{FR} = 200 \text{ €} e^{0.036 \times 1} - 200 \text{ €} = 7.33 \text{ €}$$

We have not information about the investment for buying the stocks, but looking only at the profits, the highest one is provided by stocks

Excercise #3 - Solution

► Data:

$$P_0^{IT} = 100 \text{ €}; r^{IT} = 0.04; \tau = 1/2$$

$$P_0^{FR} = 200 \text{ €}; r^{FR} = 0.036; \tau = 1/2$$

stocks profit after 6 months 3.5 €

► Then, the continuously compounded profits for bonds are:

$$P_{1y}^{IT} - P_0^{IT} = 100 \text{ €} e^{0.04 \times 0.5} - 100 \text{ €} = 2.02 \text{ €}$$

$$P_{1y}^{FR} - P_0^{FR} = 200 \text{ €} e^{0.036 \times 0.5} - 200 \text{ €} = 3.63 \text{ €}$$

Looking only at the profits, the highest one, in this case, is provided by french bonds.

Remind that, having 200 € to invest in french bonds means that you could invest twice in italian bonds, obtaining a profit of 4.04 € at 6 months, that is higher than 3.5 €